

Original Paper

## FIRST RECORD OF AGGLUTINATED FORAMINIFERA FROM LOMBOK

Suhartati M. Natsir\*

Research Center for Oceanography – Indonesian Institute for Science  
Jl. Pasir Putih 1, Ancol Timur, Jakarta, Indonesia (14430)

Received : August 28<sup>th</sup> 2009 ; Accepted : September, 23<sup>th</sup> 2009

### ABSTRACT

*Study on the distribution of benthic foraminifera in Gili Trawangan, Gili Meno and Gili Air Lombok Island was held during November 28<sup>th</sup> – December 5<sup>th</sup>, 2008. Agglutinated foraminifera were given special attention since there have been so few records on the occurrence of this group from Indonesia. The aims of the study were to have general indication about the type and abundance of agglutinated foraminifera found in Lombok. From the 4 stations studied in each Gili, 6 species were observed at Gili Trawangan and Gili Meno, and 7 species in Gili Air. The stations which are located close to the bay normally have more individuals than ones away from it especially *Ammobaculites agglutinans* and *Haplophragmoides canariensis*.*

**Keywords:** Agglutinated foraminifera, Gili Trawangan, Gili Meno, Gili Air, Lombok, Indonesia.

**Correspondence :** Phone : +62-21-64713850, Fax : +62-21-6471948; [suhartatinatsir@yahoo.com](mailto:suhartatinatsir@yahoo.com)

### INTRODUCTION

Foraminifera are group of animals generally live in the sea. They are sensitive organisms on environmental change have various distribution and only in certain sites. Shell of death foraminifera will be sunk down and accumulated in certain sea floor, than became clue to recognize the correlation of rocks age and geological past. Micropaleontology study is generally based on foraminifers' microfossils. The specialty of foraminifera became causal using on the study such as simplicity on preparation technique and relatively cheap (Suhartati, 1991). Foraminifera naturally live in dwelling sediment of the sea as abundant microbenthic and depth as an ecological factor have affect to their distribution (Boltovskoy and Wright, 1976). Thus, they inhabit wherever the sea, many have

short live cycle and advantage as good for environmental indicators.

Agglutinated foraminifera are characterized by its test wall, made of coarse sand grains from their substrate and surroundings. Agglutinated foraminifera were recognized on coral reefs where lie on warm waters within sunlight and high calcium carbonate concentration. Those have high salinity are inhabitable sites for agglutinated foraminifers to live on. They agglutinate on the reefs as epifauna (Helfinalis dan Rositasari, 1988).

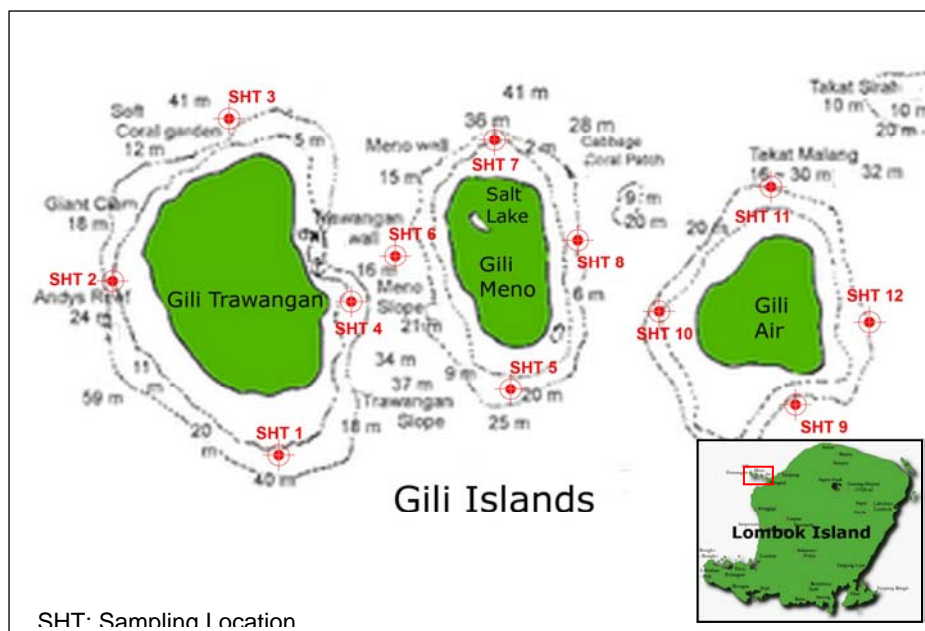
Research conducted in tropical or subtropical areas indicated that there is a tendency for the agglutinated foraminifera to be dominant in almost every disadvantageous environment such as in areas under pressure and close to the bay and mouth of the river.

During a study on the distribution and abundance of benthic foraminifera in Gili Trawangan, Gili Meno and Gili Air (Lombok Island), the agglutinated foraminifera were given special attention because the areas studies are relatively close to the bay, and only few records on the occurrence of this special group of organism from Indonesia. It is expected that the results of this research have general indication about the type and abundance of agglutinated foraminifera in Lombok.

## MATERIAL AND METHODS

### Sampling

Samples were collected at each 4 stations of Gili Air, Gili Meno and Gili Trawangan during November 28<sup>th</sup> December, 2008. The stations of the sampling location were noticed by SHT (fig. 1). The samples were taken with a *Van Veen Grab Sampler* and placed in plastic bags, and then preserved by formaldehyde 10% for 24 hours.



**Fig 1.** Sampling Locations of Gili Islands, Lombok, noticed by SHT

### *Preparation of sample*

Collected sample consist of whole seabed materials such as sediment materials and organisms including benthic foraminifera. This preparation is necessity operation to separate benthic foraminifera from the other materials and organisms. This stage is held by washing, picking, description and identification, and sticking and documentation.

### *Washing*

Each sample are weighed on at 100 grams and put in to labeled plastic bag. The samples get a soaking in formaldehyde 10% for 24 hours, then washed by water on a filter tray and dried

by oven at temperature 30°C. Dried samples are put in to labeled plastic bag for advance analysis. After washing and filtering, the filter tray has to get a soaking in methilene blue to keep away from contaminant, and then washed.

### *Picking*

Picking up the specimen which is suggested as benthic foraminifera from the collected sediment and separate them for further analysis. The washed materials are spreaded out on the extraction tray under microscope view. Recognized foraminifera are picked up and keep in foraminiferal slide.

### Description and Identification

The picked specimens are described based on their morphology such as shell, chamber shape, chamber formation, number of chamber, ornamentation, aperture slope, aperture position and additional chamber. Identification on the specimens is held based on references of benthic foraminifers. Advance stages are systemic study and quantitative analysis to recognize the abundance.

### Sticking and documentation

The specimen that was chosen is stuck to foraminiferal slide at the aperture view, dorsal view, ventral view and side view, than documented under microscope.

### Ecological parameter measurements

Depth measurements on each station were done with a Hand Held Submersible Depth Sounder.

Temperature was measured with a Portable Thermometer, salinity was measured with salinity refractometer and level of pH was determined with an instruments pH meter.

## RESULTS AND DISCUSSION

### Results

As very little is known about the agglutinated foraminifera of Indonesia, there were no data of agglutinated foraminifera especially from Lombok. The result obtained from the study is taxonomically given below (see Fig 2, Table 1, Table 2 and Table 3).

**Table 1.** Number of agglutinated foraminifera, collected from Gili Trawangan.

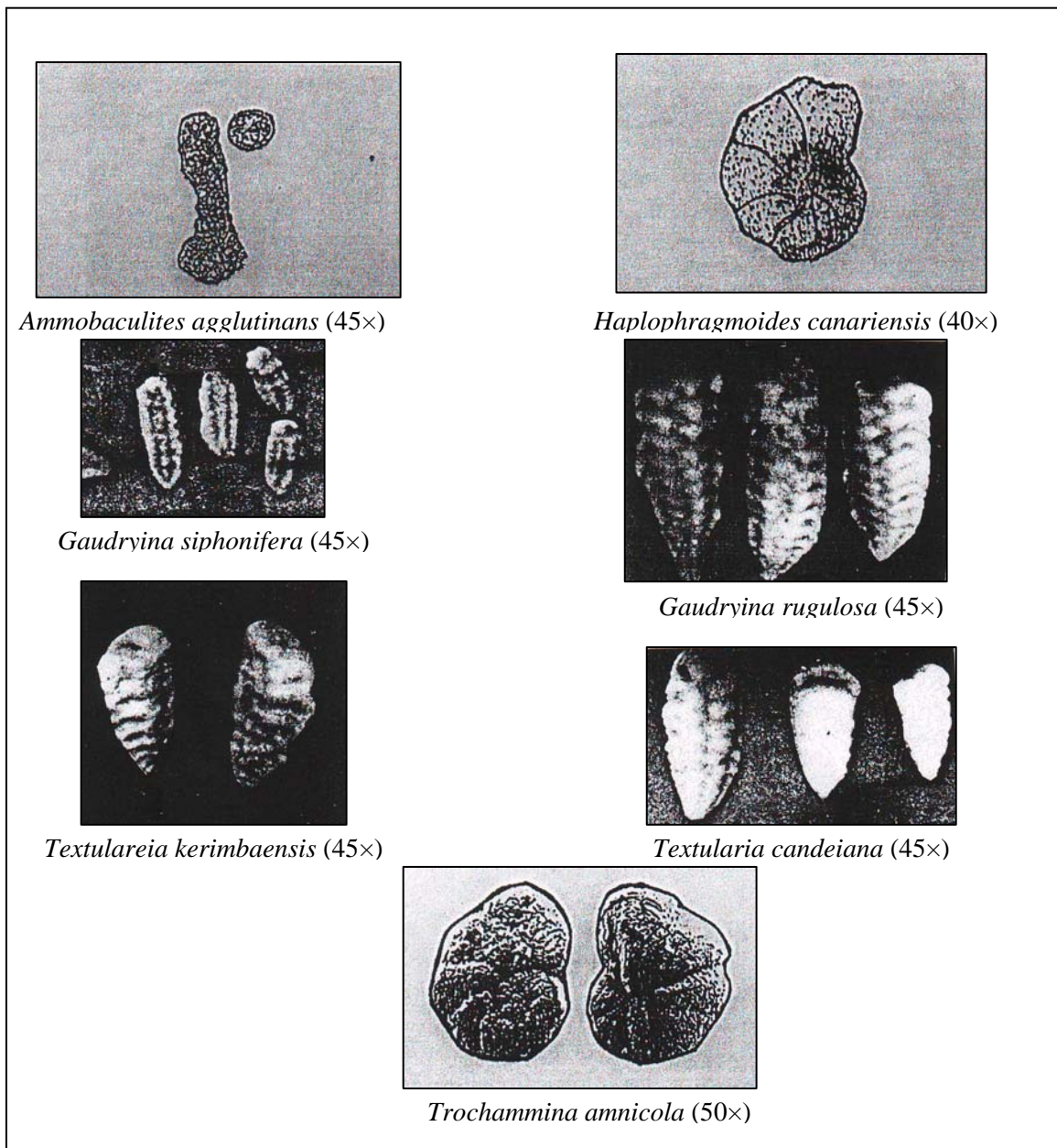
Species/Station	Number of Specimens			
	SHT 1	SHT 2	SHT 3	SHT 4
<i>Ammobaculites agglutinans</i> (d'Orbigny)	38	20	24	22
<i>Haplophragmoides canariensis</i> (d'Orbigny)	22	16	16	12
<i>Gaudryina rugulosa</i> (Chusman)	14	7	4	9
<i>Gaudryina siphonifera</i> (Brady)	15	4	2	10
<i>Textularia candeiana</i> (d'Orbigny)	20	9	7	8
<i>Textularia kerimbaensis</i> (Said)	21	7	8	8

**Table 2.** Number of agglutinated foraminifera, collected from Gili Meno.

Species/Station	Number of Specimens			
	SHT 5	SHT 6	SHT 7	SHT 8
<i>Ammobaculites agglutinans</i> (d'Orbigny)	28	16	16	18
<i>Haplophragmoides canariensis</i> (d'Orbigny)	24	26	28	19
<i>Gaudryina rugulosa</i> (Chusman)	14	7	7	14
<i>Gaudryina siphonifera</i> (Brady)	16	9	7	9
<i>Textularia candeiana</i> (d'Orbigny)	28	10	9	19
<i>Textularia kerimbaensis</i> (Said)	31	11	7	11

**Table 3.** Number of agglutinated foraminifera, collected from Gili Air.

Species/Station	Number of Specimens			
	SHT 9	SHT 10	SHT 11	SHT 12
<i>Ammobaculites agglutinans</i> (d'Orbigny)	66	18	28	32
<i>Haplophragmoides canariensis</i> (d'Orbigny)	49	22	22	27
<i>Gaudryina rugulosa</i> (Chusman)	29	12	12	24
<i>Gaudryina siphonifera</i> (Brady)	29	14	13	20
<i>Textularia candeiana</i> (d'Orbigny)	20	12	11	29
<i>Textularia kerimbaensis</i> (Said)	20	19	19	26
<i>Trochammina amnicola</i> (Bronnimann)	30	16	14	22



**Fig 2.** Agglutinated Foraminifera from The Gili Trawangan, Gili Meno and Gili Air, Lombok.

Tabel 4. Morphological characteristics, distributions and environment conditions of collected agglutinated foraminifera from Lombok

Species	Morphology	Distribution	Environment Condition
<b>Family Lituolidae</b>			
<i>Ammobaculites agglutinans</i> (d'Orbigny)	Test free, the test informed by an early part with coiled section and followed by an uncoiled section, wall arenaceous with a chitinous lining. The chambers of the uncoiled portion have same width and with sutures at right angle to the axis of growth.	South and North Atlantic, Pacific, India (on coral reefs), Java, Lombok (Indonesia).	Depth : 22.5 – 38 m Substrate : Sandy mud Salinity : 30.24 – 30.38 ‰ pH : 7.9 – 8.0 Temperature : 29.0 – 29.5 °C. Turbidity : 7.5 – 8.5 mg
<i>Haplophragmoides canariensis</i> (d'Orbigny)	Test free, planispiral of several coils, usually not completely involute, chambers simple, single, wall arenaceous, firmly cemented. Amount of cement varying greatly in different species, aperture simple at the base of the apertural face of the chamber	South and North Atlantic, The Hebrides, Scotland, Prince Edward Island (Pacific ocean), Java, Lombok (Indonesia).	Depth : 22.5 – 38 m Substrate : Sandy mud and sand Salinity : 30.24 – 30.38 ‰ pH : 7.9 – 8.0 Temperature : 29.0 – 29.5 °C Turbidity : 7.5 – 8.5 mg
<b>Family Verneulinidae</b>			
<i>Gaudryina rugulosa</i> (Chusman)	Chambers triserial, the adult biserial, the early portion typically triangular with distinct angles, sutures usually distinct except in the early portion, wall arenaceous, the surface very rough to smooth, aperture in early stages at the inner margin of the last formed chamber. Jurassic to recent	South and North Atlantic, Pacific, India, Java, Lombok (Indonesia)	Depth : 22.5 – 38 m Substrate : Sand Salinity : 30.24 – 30.38 ‰ pH : 7.9 – 8.0 Temperature : 29.0 – 29.5 °C Turbidity : 7.5 – 8.5 mg
<i>Gaudryina siphinofera</i> (Brady)	Test in the young a trochoid spire, chambers triserial, triangular, chambers usually five in the first late reducing to four, three and simple, wall arenaceous, aperture just above the base of inner chamber margin. Jurassic to recent.	South and North Atlantic, Pacific, India, Java, Lombok (Indonesia)	Depth : 22.5 – 38 m Substrate : Sand Salinity : 30.24 – 30.38 ‰ pH : 7.9 – 8.0 Temperature : 29.0 – 29.5 °C Turbidity : 7.5 – 8.5 mg

Species	Morphology	Distribution	Environment Condition	
Family <b>Textulariidae</b>				
<i>Textularia candeiana</i> (d'Orbigny)	Test conical, the early stages triserial with three or more chambers in the first whorl, chambers subdivided toward the periphery, wall arenaceous, aperture in the adult terminal. Cretaceous to recent.	South and North Atlantic, Pacific, India and Java, Lombok (Indonesia).	Depth : 22.5 – 38 m Substrate : Sand Salinity : 30.24 – 30.38 ‰ pH : 7.9 – 8.0 Temperature : 29.0 – 29.5 °C Turbidity : 7.5 – 8.5 mg	
<i>Textularia kerimbaensis</i> (Said)	Test at the early stages triserial, usually triangular with sharp angles, wall arenaceous, aperture terminal, rounded. Cretaceous to recent.	South and North Atlantic, Pacific, India and Java, Lombok (Indonesia).	Depth : 22.5 – 38 m Substrate : Sand Salinity : 30.24 – 30.38 ‰ pH : 7.9 – 8.0 Temperature : 29.0 – 29.5 °C Turbidity : 7.5 – 8.5 mg	
Family <b>Trochamminidae</b>				
<i>Trochammina amnicola</i> (Bronnimann)	Test is slightly convex spirally and strongly convex umbilically with a closed axial depression. The periphery is rounded subangular and the chambers are elongate triangular almost pointed toward the axis of the enrollment wall imperforate, coarser on the spiral than on the umbilical side and contains over the flatten to slightly concave apertural face rather coarse element	Brunei, Sabah (Malaysia), Java, Lombok (Indonesia).	Depth : 22.5 – 34 m Substrate : Sandy and sandy mud Salinity : 30.24 – 30.38 ‰ pH : 7.9 – 8.0 Temperature : 29.0 – 29.5 °C Turbidity : 7.5 – 8.5 mg	

## Discussion

Agglutinated foraminifera are characterized by its test wall, made of coarse sand grains from their substrate and surroundings. Agglutinated foraminifera were recognized on coral reefs where lie on warm waters within sunlight and high calcium carbonate concentration. Those have high salinity are inhabitable sites for agglutinated foraminifera which agglutinate on the reefs as epifauna (Helfinalis dan Rositasari, 1988). Gili Islands have sand substrate within coral reefs extended around the islands. It was an eligible habitat for agglutinated foraminifera to live on, indicated by high number of collectable agglutinated foraminifera of those islands, totally more than 1000 specimens. Most of specimens were collected from Southern part of the islands (**Table 1, Table 2 and Table 3**).

Gili Trawangan and Gili Meno have six species of agglutinated foraminifera which were found at 11 stations, such as *Ammobaculites agglutinans*, *Haplophragmoides canariensis*, *Gaudryina rugulosa*, *Gaudryina siphonifera*, *Textularia candeiiana* and *Textularia kerimbaensis* (**Fig. 2**). The same six species were found in Gili Air with an additional one, *Trochammina amnicola*. The most abundant species, *Ammobaculites agglutinans* and *Haplophragmoides canariensis* were especially abundant at station located close to the Kombal Bay. It is known that the area of the station is a place where materials from the land are ultimately accumulated and deposited. Accordingly, the possibility of the two types are abundantly found in the areas are those fit to the environment requirement.

*Trochammina amnicola* is only found in the Gili Air. This species was found previously in brackish water in Brunai and Sabah by Bronnimann and Keij (1986). The Gili Air has more individuals of foraminifera than the Gili Trawangan and Gili Meno. The cause of this condition is the proximity of Gili Air to the bay which is exceedingly influenced by brackish water.

Study on effect of substrate on benthic foraminifera distribution is somewhat difficult because it is attributed to other factor include turbidity. Dodd and Stanton (1981) declare that substrate has influence to agglutinated foraminifera that made from external compound. Substrate has influence to morphology and their distribution (Buzas and Sen Gupta, 1982). It is known that the Gili Air is dominated by sandy and sandy mud sediment (**Table 4**), and that agglutinated foraminifera construct their test from sediment particles, such as sand, mud, oolites, calcitic microgranules and the test of other microorganism (Kiminski, 1985). Therefore, the number of specimens in the area may be related not only to the surrounding water conditions but also related to the sediment where they live (Suhartati, 1988). Apart from the sediment factor, the degree of pollution may also responsible for this abundance. Compare to the Gili Trawangan and Gili Meno, the Gili Air might receive more materials and the sediment consist of sand mud and the water turbidity higher compare to that of two other Gili.

## CONCLUSIONS

Gili Trawangan and Gili Meno have six species of agglutinated foraminifera such as *Ammobaculites agglutinans*, *Haplophragmoides canariensis*, *Gaudryina rugulosa*, *Gaudryina siphonifera*, *Textularia candeiiana* and *Textularia kerimbaensis*. On the other hand, Gili Air has same species such the two previous Gili with an additional one, *Trochammina amnicola*. The stations which are close to the bay normally have more individuals than ones away from it especially *Ammobaculites agglutinans* and *Haplophragmoides canariensis*.

## REFERENCES

- Boltovskoy, E. and R. Wright. 1976. Recent Foraminifera. Dr. W. June, B. V. Publisher, The Hague, Netherland.
- Bronnimann, P. 1986. Paratrochammina (Lepidoparatrochammina) quaratibaensis n. sp from Brackish Waters of Brazil and Check List of Brackish Water Trochamminaceans, *Rev. Paleobiol*, 5 (2): 221 – 229.
- Bronnimann, P. and Keij, A. J. 1986. Agglutinated Foraminifera (Lituolacea) from Brackish Waters of The State of Brunei and of Sabah Malaysia, Northwest Borneo. *Revue de Paleobiologie*, 5 (1): 11 – 31.
- Buzas, M. A. and B. K. Gupta. 1982. Foraminifera. Notes for a Short Course. University of Tennessee. Departement of Geological Science, Louisiana.
- Chapman, F and Parr, W. J. 1937. Foraminifera. Australasian Antarctic Expedition. Scr. C1: 1 – 190.
- Helfinalis dan R. Rositasari. 1988. Foraminifera di Lingkungan Terumbu Karang Pulau Pari. Teluk Jakarta. Lembaga Ilmu Pengetahuan Indonesia. Pusat Penelitian dan Pengembangan Oseanologi, Jakarta.
- Kiminski, M. A. 1985. Eridence of Control of Abyssal Agglutinated Foraminiferal Community Structure by ubstrate Disturbance, Results from The Hebble Area. *Mar. Geol.* 66: 113 – 131
- Defrance, J. L. M. 1824. Articles on Various Genera of Foraminifera in Dictionnaire des Sciences Naturelles, Strassburg.
- d'Orbigny, A. D. 1846. Tableau Methodique de La Classe des Cephalopodes. *Sci. Nat.* 7: 245 – 314.
- Parker, W. K. 1870. The Species Founded Upon The Figures. Soldani's Testaceographia ac Zoophytographia. Ser. 48: 8 – 179.
- Suhartati, M. N. 1988. First Note of Brackish Water Agglutinated Foraminifera from Jawa. *Tropical Biodiv.* 5 (1): 57 – 63.
- Suhartati, M. N. 1991. Pengamatan Dalam Penggunaan Data Fosil Mikroforam Untuk Analisis Geologi. *Lembar Publikasi Lemigas* No. 2. Vol. 25. Lembaga Minyak dan Gas Bumi, Jakarta. Hal. 165-174.